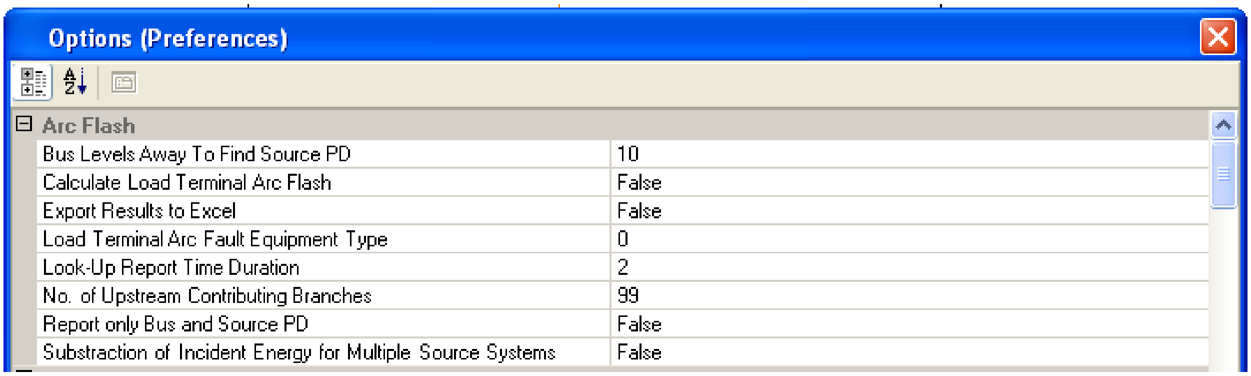
Arc Flash Exercise 7 - Solutions

Purpose & Description

The purpose of this exercise is to illustrate the features and capabilities of the ETAP 1-Phase Arc Flash program. Different systems are analyzed including 1-phase systems fed from power panels or from uninterruptible power supplies. 1-phase distribution systems are also included in this example with a simple 12 kV 1-phase transmission line feeding 1-phase loads.

Setup

Load the project file named “Arc Flash Example 7”. The solution to this example is located in a directory called “Solution”. Open the solution project only to compare against your exercise once completed. Before continuing with this exercise, please make sure that the following settings are selected from the Options (preferences) editor:



Arc Flash	
Bus Levels Away To Find Source PD	10
Calculate Load Terminal Arc Flash	False
Export Results to Excel	False
Load Terminal Arc Fault Equipment Type	0
Look-Up Report Time Duration	2
No. of Upstream Contributing Branches	99
Report only Bus and Source PD	False
Substraction of Incident Energy for Multiple Source Systems	False

Procedure

Step1

Open study case “AF-1-Phase”. In the Info page, select to include “Panel”, “UPS” & “1-Phase” systems for the 1-Phase arc flash calculation. Now Go to the Arc Flash page and select the 1-Phase option. This option will allow you to fault all 1-phase buses connected below the items selected in the Info page.

Run 1-Phase AF calculation and name the report “AF-1-Phase”. Answer the following questions:

1.1 What bolted short-circuit current level is used by the program to determine the 1-phase arcing currents? (Clue: look at the display options and select Ibf-Bolted Fault Currents)

Subtransient Half cycle fault current levels (Ibf”).
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1.2 What buses have arcing current variation problems? (Clue: Use the AFRA to determine this)

Buses Bus8, Bus10 & Bus12 have arcing current variation problems. This can be determined from the AFRA.
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Step2

Open study case “AF-1-Phase”. In the Arc Flash page activate the options “Hazard Cat for LV equipment” & the “Limit Maximum FCT” (set to 2 seconds). De-activate the UPS Bypass switch. Run AF and name the report “AF-1-Phase-MaxFCT”

2.1 Based on the low voltage and low kVA criteria, which bus was automatically assigned a low hazard?

Only Bus8 qualifies to be automatically assigned a low hazard. Use the AFRA “Force Cat for LV Equip” option to determine this.
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2.2 Which buses have a final clearing time longer than 120 cycles?

Bus6 & Bus7 have an FCT longer than 120 cycles. Use the AFRA to determine this. There is not enough fault current level to operate the protective devices fast enough. The energy cannot really be determined but up to 2 seconds only.
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2.3 What is the effect of the Bypass switch in the Arc Flash calculation? Why is the current contribution so drastically reduced?

The Bypass switch disconnects the main input from the UPS output. The UPS short-circuit contribution now becomes K* UPS FLA (where K is a multiplier factor typically set to 1.5).
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2.4 For which bus does the program determine that the “First Upstream Protective Device” does not clear the fault?

The AFRA predicts that Bus3 and Bus7 fall under this category.
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2.5 For which buses were the Maximum Fault Clearing Time exceeded?

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